IES
Newsletter

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The Institute of Ecosystem Studies has been fortunate over the past few years to have the assistance of young professionals working through service organizations such as AmeriCorps and the Student Conservation Association.

These interns, who typically spend from several months to two years at IES, have worked in the Education Program and in the Native Plant Program. They have lent their energy and creativity to developing and teaching our Ecology Field Programs for School Groups. They have written articles for the *IES Newsletter*, including this issue (page 3), and have created interpretive materials for the many visitors to our display gardens; one such, a *Fern Glen Trail Guide*, will be published shortly. They also have contributed their time to the local community, as educators, scout leaders and, in one case, as an EMT.

We thank our interns, past, present and future. Their contributions to the Institute's programs are outstanding.

The *IES Newsletter* is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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Do the Few Speak for the Many? – Bacteria and Carbon in the Hudson River

MOUNT MARCY, Adirondack Park — Water flowing down the slopes of Mount Marcy, the highest peak in New York state, is the source of the Hudson River. And the soils and hillsides of surrounding Essex County, 375 miles north of where the river flows into New York Harbor, are just the first of some 13,000 square miles of watersheds that drain into tributaries and into the Hudson River itself. The river, for all its power, is at the mercy of these watersheds when it comes to the quality of its ecosystem, and the long-term health of this most majestic of waters depends in no small measure upon resident creatures that are essentially invisible.

MILLBROOK, N.Y. — Scientists at the Institute of Ecosystem Studies are studying the ecology of the Hudson River, from its microscopic primary producers to the larger plants and animals whose lives depend on their tiny rivermates. The newest member of the scientific team is postdoctoral associate Dr. Roxane Maranger, whose research is supported by the Natural Sciences and Engineering Research Council (NSERC) of Canada. Dr. Maranger is studying microbial carbon dynamics, the exchange of carbon (a nutrient that is critical for life) between bacteria and the river environment.

Bacteria are just single-celled organisms but they are major forces in all the world's rivers, and they play an especially important role in the Hudson River ecosystem. An average bacterium is 1 μ-meter long – it would take about 25,400 of them, in a line, to reach 2.5 cm (one inch). How can such miniscule creatures be so powerful? The answer lies in their ability to convert nutrients to living matter: their role in the carbon cycle involves production, the process by which they take up carbon to create cellular material, and respiration, during which they release carbon back to the environment. The balance of these two processes – production and respiration – will determine whether bacteria act to add organic carbon to, or remove it from, the river.

Maranger's research spans the distance from Albany south to the Tappan Zee Bridge some 45 kilometers (28 miles) north of New York Harbor. Working in the river's deep central channel, she collects water samples each month, from April through October, at 40 stations regularly spaced along this 200 km (125 mi) tidal freshwater reach. One of her goals is to determine if there is a spatial pattern to microbial production and respiration, and if knowledge of this pattern can aid in understanding the whole river system. In other words, can data gathered at one part of the river be extrapolated to other parts?

"Historically," explains Maranger, "production has been the focus of attention, but in the last decade or so more emphasis has been put on respiration as an important component of carbon dynamics." After analyzing the samples she collected last year, Maranger found that while respiration remains more or less the same along the entire transect, production rates were higher in the northern reaches — more carbon was being converted to biomass in that part of the river.

What drives the production part of the microbial carbon cycle? She has two hypotheses. First, in the portion of the river near Albany, the organic matter that bacteria consume may be of higher nutritional value. And second, there is less grazing pressure there than in the southern stretch, where there are more zebra mussels and other consumers. In other words, in the northern

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LONNA KELLY

Rivers are Roxane Maranger's outdoor laboratories.

Bacteria and Carbon, *from page 1*

part of the river, production is being controlled from the bottom (food quality) up, and, to the south, from the top (predators) down. However, with respiration levels remaining relatively constant along the length of the study area, Maranger determined that we can estimate the bacterial carbon balance of whole reaches of the river using results from a few sampling sites.

Of all the major aquatic ecosystems, rivers remain the most poorly understood. Not only that, but large rivers tend to be heavily affected by pollutants. "Because of the work done by IES ecologists over the years," Maranger says, "there's a good understanding of the Hudson River ecosystem. This isn't necessarily true of other rivers. I came to the Institute of Ecosystem Studies in order to learn more about how to study river dynamics." Maranger will carry these skills with her when she continues her research in other, less well-studied aquatic systems.

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Roxane J. Maranger's two year postdoctoral appointment at IES began in January 2000, after she received her doctorate in environmental science at the Université du Québec à Montréal. As an undergraduate at McGill University, also in Montreal, with a joint major in biology and drama, she found the theories of behavioral ecology and social structure to be useful in her drama studies. Those who know her here at IES — for example, the volunteers attending the Institute's annual Volunteer Recognition Ceremony in April, where she was the guest speaker — will agree that she can also bring a touch of the theater to explanations of ecology. Maranger credits her interest in all things aquatic to childhood summers spent on a lake in northern Ontario.

Maranger collaborates on this study with Drs. Michael Pace, at IES, and Paul del Giorgio, himself a former IES postdoctoral associate now working at the University of Maryland's Horn Point Laboratory. Maranger is supported in her work by research assistants David Fischer (see following article), Heather Malcom, Alex Nixon and Gregory Lampman. ●

Research Support Staff: Part 2 of a Series

David Fischer, of the Hudson River Group

There's a spot in the Hudson River, between Rhinecliff on the eastern shore and Kingston to the west, that David Fischer has visited every two weeks, from April to December, since 1987. Routine collection of water samples from this spot, east of the shipping channel where the water is approximately 7 meters (just over 20 feet) deep, provides a continuous record of physical, chemical and biological parameters. The resulting long-term data are a baseline against which Institute of Ecosystem Studies scientists and their colleagues elsewhere can monitor changes in the Hudson River.

SUSAN DYE

David Fischer is a key player with the IES Hudson River research team.

But this biweekly voyage is only one of the jobs on Fischer's task list. As research assistant for Drs. Michael Pace and Stuart Findlay, he also lends his expertise to their postdoctoral associates, graduate students and Research Experiences for Undergraduates students, dividing his time between work in the field — primarily on the Hudson River but also on local lakes and streams and at on-site experiments — and in the laboratory.

A typical day of field work on the Hudson River begins when Fischer picks up the Institute's Boston whaler on its trailer, and drives to a public boat ramp on the river's eastern shore. At the sampling sites, either the long-term monitoring station described above or at other locations, he collects river water and makes some measurements immediately while preserving the rest of the sample for later analysis in the laboratory. When assisting Dr. Maranger (see previous article), for example, he pilots the boat from Albany to the Tappan Zee Bridge, collects samples at the 40 stations, and uses an automatic sensor called a sonde to measure temperature, dissolved oxygen and turbidity. He preserves the remainder of each sample for laboratory measurements of seston (suspended particulate matter), dissolved organic carbon, and bacterial production. His field work for Pace, Findlay and the others involves similar techniques and analyses.

Fischer has been involved in some large-scale experiments done on-site at the Institute as well. For example, several years ago he helped Findlay and former graduate student William Sobczak build and use a hyporheotron, a device that mimics the flow of a stream through sediment. Its use facilitates study of the microbial community that thrives in hyporheic sediments, the gravel bars through which water flows along the course of a meandering stream. The IES hyporheotron is a 3-meter (approx. 10 foot) pipe partially filled with gravel; as stream water flows through the pipe, the scientists sample oxygen, dissolved organic carbon and the microbial community itself — bacterial numbers and production levels — at intervals along its length.

With this year's field season underway, Fischer's skills are in demand. In addition to setting up hyporheotrons at IES, assisting undergraduate and graduate students with their field work, and continuing sampling and routine monitoring in the Hudson River, he will work for a while in Michigan and Wisconsin. There, at the University of Notre Dame Environmental Research Center, he has been asked to train a new research assistant working with Drs. Pace and Jonathan Cole on a lake study. ●

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David Fischer joined the Institute's staff in 1987, after receiving his bachelor's degree in ecology at the State University of New York in Purchase. He and his wife Heather, whom he met while at Purchase, and their daughter Maya live in Dover Plains, N.Y.

Forest-Free "Domtar Weeds"

We're trying something new with the *IES Newsletter*: beginning with the previous issue, it is being printed on a new paper, called Domtar Weeds, made of non-tree fibers from sugar cane and hemp plants.

Sugar cane is one of the world's most widely grown crops; as such, its fibers — natural by-products of sugar-making — are readily available for other uses. Hemp, the strongest natural fiber, lends strength and durability to the paper. In addition, it takes less energy to process and can be recycled more times than wood fiber.

Beyond Syrup: Ecological Connections in the Sugar Bush

by Jamie McBride

I'm awake again! The temperature is rising and it's starting to feel like spring. It seems like just yesterday I was basking in the summer sun, spreading my leaves to its warm rays. I made food through photosynthesis and used that food to grow stronger, produce seeds, and prepare for winter. It was a great year to be a tree! When the weather finally turned cool, I was ready for a long winter rest. I had stored food and nutrients in my trunk and roots, and when my last leaf fell I gradually shut down and waited out the winter. Now it's getting warmer and the forest is coming alive. The food I stored last fall will help me get my new leaves growing ...

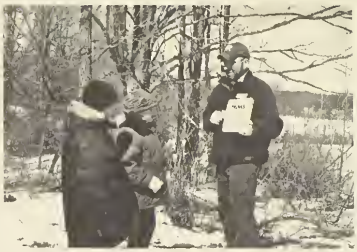
The sugar maple (*Acer saccharum*) — like all plants — photosynthesizes to make its food. Photosynthesis is the process by which light energy from the sun is captured and used to make sugar from carbon dioxide and water. While the plant uses much of this sugar immediately, it stores some over the winter to give energy for spring growth. As water enters the tree through the roots, it picks up some of the stored sugar; this sugary water is called sap. Exactly what makes sap flow up from the roots to branches is not completely understood, but research by the U.S. Forest Service suggests the explanation lies in positive pressure that builds inside the tree from springtime temperature fluctuations.

If tree bark is penetrated, sap oozes out of the hole due to the built up pressure. Humans take advantage of this. During March you may see buckets or tubes hanging from sugar maple trunks collecting sap that will be boiled down to make syrup. Sugar maple sap (which this article may help you appreciate more the next time you pour syrup over your pancakes!), is one of the links we humans have to the sugar maple.

What other species interact with this tree? Like humans, the yellow-bellied sapsucker and winter stonefly are attracted to its sap. Defoliating insects and white-tailed deer browse on its leaves, twigs, and buds. The eastern bluebird and red squirrel are among the animals that use the tree for shelter. The tree benefits from relationships as well: mycorrhizal fungi, for example, live on the roots and help the sugar maple bring in nutrients and water.

Let's focus on two of the creatures that interact with the sugar maple, the yellow-bellied sapsucker and the fiery searcher.

The sapsucker, a woodpecker, taps holes in the bark of the tree and eats the flowing sap. This interaction may seem small, but it is part of a larger chain of events. Sap-eating insects, for example, are attracted to the oozing woodpecker holes. When the sapsucker, whose diet is not solely vegetarian, comes to the tapped holes it finds a concentration of insects and has a nourishing meal. Other animals, like warblers, kinglets, and squirrels, also eat both sap and insects, and will make woodpecker holes their feeding station. Fungi, entering "wounds" in the bark, can attack the heartwood. As the wood decays and cavities develop, sapsuckers may find shelter there and an abandoned sapsucker nest may in turn become a home to other cavity nesters such as the eastern bluebird and black-capped chickadee.



LONNA KELLY

During March, 28 school groups came to the Institute to learn about the ecology of the sugar bush. Here, with 3rd graders from the Titusville Intermediate School in Poughkeepsie, N.Y., is IES educator Jamie McBride, a Student Conservation Association intern.

The fiery searcher, a black and green beetle between 25-36 millimeters (1- 1 " inches) long, feeds on leaf-eating caterpillars. Since leaves are the site of photosynthesis, the protection these beetles afford is crucial to the well-being of the tree. The fiery searcher lives under leaves and debris on the forest floor and will climb sugar maples in search of food. The tree provides habitat, shade and a supply of caterpillars, while the beetle provides a service by eating herbivorous insects. Unfortunately for the beetle, its presence may draw insect-eating birds like the American robin, which could limit the numbers of fiery searchers.

Over the past 50 years there has been evidence that sugar maple trees are declining in number through human accelerated environmental change including acid rain and the use of road salt. An article published recently in *Bioscience* by a number of scientists including the Institute's own Drs. Gene Likens and Kathleen Weathers and Mr. Thomas Butler, reported positive correlations between acid rain deposition and sugar maple diebacks in the Northeast*. Like the taste of syrup on the morning pancakes, this is a reminder that humans are a part of all of Earth's ecosystems, not separated from them. We alter the Earth to suit our needs and, like other species, our actions are not free of consequences. ●

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Jamie McBride came to IES as an intern though the Student Conservation Association and Audubon Expedition Institute where he is completing a master's degree in environmental education. While at IES, Jamie worked in the Education Program teaching sugar maple ecology and assisting with curriculum development for an urban ecosystem study project in elementary schoolyards.

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* Driscoll, Charles T., Gregory B. Lawrence, Arthur J. Bulger, Thomas J. Butler, Christopher S. Cronan, Christopher Eagar, Kathleen F. Lambert, Gene E. Likens, John L. Stoddard, and Kathleen C. Weathers. Acidic Deposition in the Northeastern United States: Sources and Inputs, Ecosystem Effects, and Management Strategies. ***Bioscience** 51:3 (March 2001).*

AmeriCorps member Shannon Wood is an educator with the Institute's Ecology Field Programs. During late winter, in addition to leading Maple Sugar Ecology and Plant Power programs at IES, she volunteered her time at an After School Enrichment Program at Alden Place Elementary School in Millbrook. In a six-week "Gardening in Winter" class, she and her 3rd and 4th grade students planted, grew and observed Swiss chard, carrots, lettuce, sunflowers and alfalfa sprouts. Here, she and Leanne Keeley compare observations of a flat of seedlings.

LONNA KELLY

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Calendar

CONTINUING EDUCATION

For information, or to request a catalogue, call the Continuing Education office at 845-677-9643 or visit www.ecostudies.org/cep. May - June programs are:

Gardening

May 12: **Kitchen Gardening**
June 3 (3 sessions): **Gardening with Children**
June 23: **Beginning with Herbs**

Landscape Design

June 2: **Site Preparation for IES Gardens**
June 23-24: **Transit and Level Use**

Biology

June 9-10: **Tree Identification**
June 16: **Ethnobotany of North America**

Natural Science Illustration

May 18: **Wildlife Sketching at the Zoo**
May 19-20: **Painting Wildlife**
June 9 and 21: **Spring Field Sketching**

Natural Crafts and Skills

May 12: **Spring Nature Crafts with Kids**
June 3 or 23: **Brentwood Trellis**

Workshop

June 2: **Pond Ecology and Management**
June 16: **Backyard Wildlife Sanctuaries**

Excursion

May 19: **Catskill Mountain Ecosystems**
June 2: **Canoe Exploration of the Great Swamp**
June 9: **Ecology of Black Rock Forest**
June 16: **Touring an Ecovillage: Sirius Community**

SATURDAY ECOLOGY PROGRAM

Free public programs are held the first Saturday of each month. These guided programs begin at 10 a.m. at the Gifford House and last approximately two hours. Call 845-677-7600 ext. 321 for information on the following:

June 2: **Late Spring Wildflower Walk**
July 7: **Nature Photography**

IES SEMINARS

Free **scientific seminars** are held on Fridays from September until early May. The fall schedule will be available in August.

VOLUNTEER OPPORTUNITIES

Become an IES Docent ... For information, call Su Marcy at 845-677-7600 ext. 317.

SPRING PLANT SALE

perennials ... peonies and tree peonies ... ferns ... herbs ... shrubs and trees ... and much more

Friday, May 18: 10 a.m. - 4 p.m.
Saturday, May 19: 10 a.m. - 4 p.m.
Sunday, May 20: 11 a.m. - 4 p.m.

ART EXHIBIT

Remnants: Ancient Forests and City Trees
by Prilla Smith Brackett

Photographs that the artist took while hiking in old growth forest in New Hampshire and Maine provided the subject matter for this series of paintings. "Our view of wilderness is rooted in our 20th century consciousness," Brackett writes in the brochure accompanying her exhibit. "We see resource, recreation, opportunity where once we saw beauty. My work explores this view, depicting the precarious existence of northern New England old growth forests."

Brackett's paintings are on display at the Plant Science Building through the end of May (except Memorial Day, May 28). **Hours:** Monday through Friday from 9 a.m. - 4 p.m. Admission is by free access permit from the Gifford House (see below).

THE ECOLOGY SHOP

New in the Shop ... jar candles with pressed flower designs ... locally-made bead jewelry ... **for children** ... beetle finger puppets ... bingo games (science/nature/wildflower) ... **in the Garden Room** ... scented geraniums ... herbs ... violets ... pansies
Senior Citizens Days: 10% off on Wednesdays

HOURS

Summer Hours: April 1 - September 30
Public attractions are open Mon. - Sat., 9 a.m.-6 p.m. & Sun. 1-6 p.m., with a free permit.
(Note: The Greenhouse closes at 3:30 p.m. daily.)
The Ecology Shop is open Mon.- Fri., 11 a.m.-5 p.m., Sat. 9 a.m.-5 p.m. & Sun. 1-5 p.m.
(The shop is closed weekdays from 1-1:30 p.m.)
• ***Free permits*** *are required for visitors and are available at the Gifford House Visitor and Education Center until one hour before closing time.*

GREENHOUSE

The large century plant (*Agave americana*), a resident of the Greenhouse since 1981, suddenly began growing its once-in-a-lifetime flower on April 23. The following day, Greenhouse Manager David Bulkeley removed the ceiling pane above the plant so the stalk could grow; by the time the flower blooms, Bulkeley says, the stalk could be over 10 meters (35 feet) tall.

MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include subscription to the newsletter, member's rate for courses and excursions, a 10% discount on IES Ecology Shop purchases, and participation in a reciprocal admissions program. Individual membership: $40; family membership: $50.
Call the IES Development Office at 845-677-5343.

The Institute's Aldo Leopold Society

In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates.
Call the IES Development Office at 845-677-5343.

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... IES Website: www.ecostudies.org

For information on current IES public events and attractions, visit: www.ecostudies.org/welcome/ThisWeek.html.
For garden tips, follow the link to the Perennial Garden Archives.